LELAND

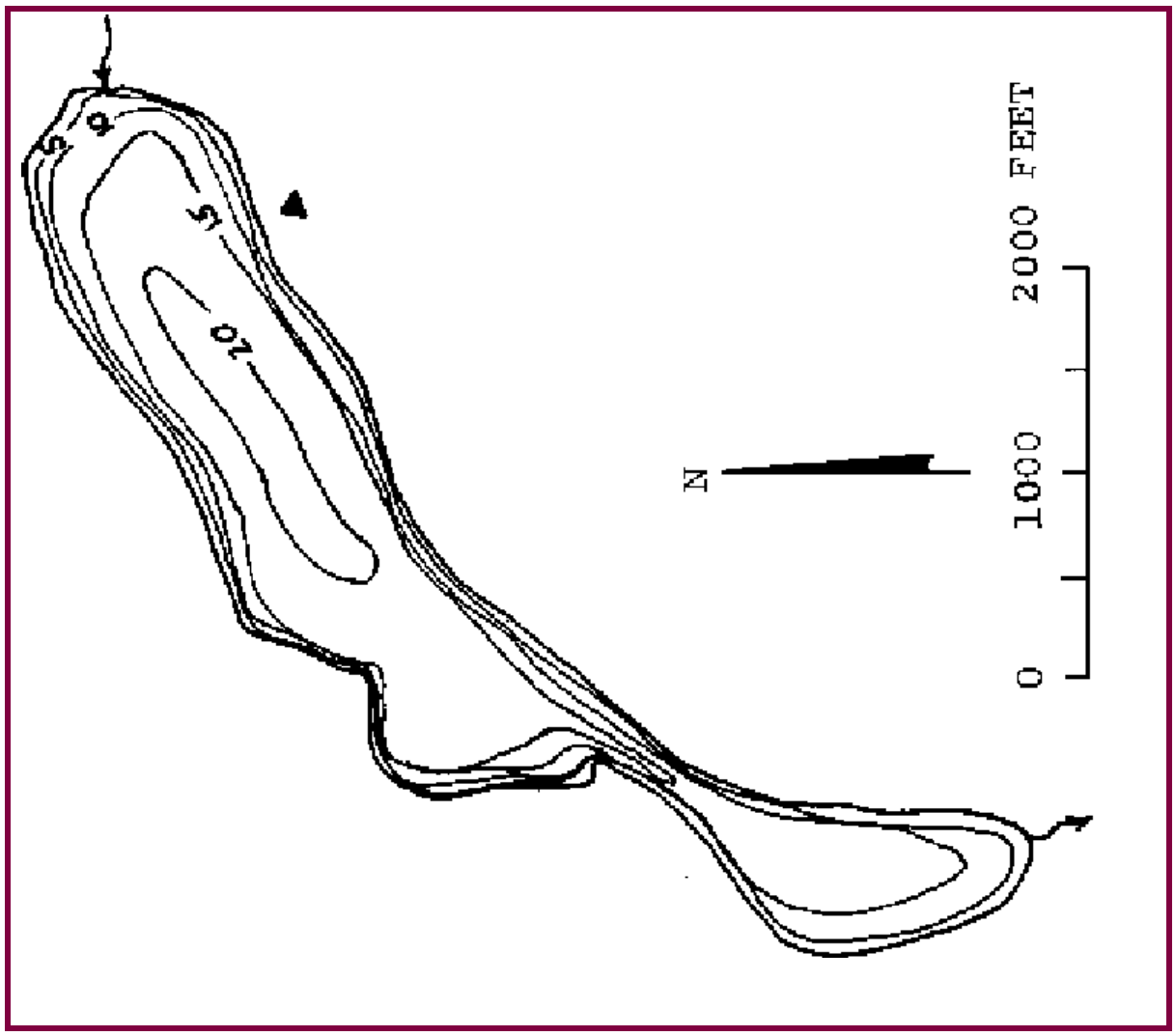
JEFFERSON County

Lake ID: LELJE1

Ecoregion: 2

Leland Lake is a prime fishing lake nestled on the eastern slopes of the Olympics. The lake is located approximately 5 miles north of Quilcene, just west of Highway 101. Leland Lake's outlet is Leland Creek which flows into the Little Quilcene River

Area (acres)	*Maximum Depth (ft)*	*Mean Depth (ft)*	*Drainage (sq mi)*	
107	20	13	6	
Volume (ac-ft)	***Shoreline (miles)***	***Altitude (ft abv msl)***	***Latitude***	***Longitude***
1415	2.75	190	47 53 12.	122 53 05.



Station Information

LELJE1

Primary Station	Station # 1	latitude: 47 56 47.3	longitude: 122 52 50.5
	Description: Deep part of lake, directly west from boat launch		
Secondary Station	Station # 2	latitude: 47 53 16.8	longitude: 122 53 18.4
	Description: Approximate center of southernmost arm of lake		

Trophic State Assessment for 1998

LELAND

Analyst: KIRK SMITH

TSI_Secchi:	47	
TSI_Phos:	48	
TSI_Chl:	51	J
Narrative TSI:[a]	ME	

Lake Leland is a productive shallow lake which has been infested with the non-native aquatic plant, Brazilian elodea (Egeria densa). Questionnaire results from residents indicate the primary use on the lake is most likely swimming/wading and the secondary use appears to be enjoyment of the view/watching wildlife. Survey respondents indicated a desire for more restrictive motorboat regulations. The survey suggests that water clarity may be impairing the water quality for swimming. Historic data suggests that there may be even fewer nutrients now than before and swimming conditions may be as good as could reasonably be expected. The lake supports a good bass fishery and water quality parameters suggests the lake could be very productive for a warmwater fishery but somewhat limiting for a coldwater fishery due to the substantial decrease in hypolimnetic oxygen in the summer.

Our mean measured total phosphorus concentration was 18.3 ug/L. We recommend the nutrient criterion for Lake Leland be set at 20ug/L total phosphorus, the action value for Puget Lowlands lower mesotrophic lakes.

[a] E=eutrophic, ME=mesoeutrophic, M=mesotrophic, OM=oligomesotrophic, O=oligotrophic

Chemistry Data

LELAND

Date	Time	Strata	Tot P (ug/L)	Tot N (mg/L)	TN:TP	Chloro-phyll (ug/L)	Fecal Col. Bacteria (#/100mL)	Hardness (mg/L)	Calcium (ug/L)	Turbidity (NTU)
Station 0										
8/12/1998		L					54			
Station 1										
6/5/1998		E	17.2	.416	24	4.3		25	5590	1 J
		H	32.6	.784	24					
7/30/1998		E	15.7	.371	24	4.6				
		H	330	1.07	3					

8/12/1998	E	18.2	.384	21	4.8	1.3
	H	254	.813	3		
9/14/1998	E	22.1	.56	25	17.5 J	2.1 J
	H	273	.725	3		
Station 2						
6/5/1998	E	14.8	.415	28		1.1 J
7/30/1998	E	22	.437	20	4.4	
8/12/1998	E	20.1	.386	19	6.8	1.3
9/14/1998	E	28.8	.57	20	19.4 J	2.1 J

Strata: L=lake surface, E=epilimnion, H=hypolimnion; Qualifier: J=Estimate, U=Less than

Watershed Survey

LELAND

Survey Date: 9/14/1998

Land Uses (1 = Primary, 2 = Secondary, etc.)

☐	**Agriculture(commercial, not hobby)**	2	**Residential**
☐	**Commercial, Industrial**	1	**Park, forest or natural**
☐	**Major transportation**		

Impervious surfaces (Roads and parking area): No Curbs

Observations (check mark denotes presence)

BMP's ☐

Lots of natural shoreline on the lake.

Odors ☐

Cattle ☐ **Ducks** ☐ **Geese** ☐

Fertilizers and weed killers appear to be used in residential or agriculture area ☐

Buffer zones around streams and wetlands ☑

Irrigation ☐

Survey Id: 50

Habitat Survey Summary Report

LELAND

Data are averages of ***10*** **Stations Surveyed** **Date of Visit:** 9/3/1998

Vegetation Type (Avg. only of sites w/ vegetation present; 1=coniferous, 3=deciduous)

Canopy Layer Avg:	1.6	**Number of stations with canopy:**	10
Understory Avg:	2.5	**Number of stations with understory:**	10

Percent Areal Coverage (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

Canopy Layer:	**trees > 0.3 m DBH**	1.7
	trees< 0.3 m DBH	1.2
Understory:	**woody shrubs saplings**	1.6
	tall herbs, forbs grasses	1.8
Ground Cover:	**woody shrubs seedlings**	0.7
	herbs, forbs, grasses	1.4
	standing water or inundated veg	1.5
	barren or buildings	0.5
Substrate Type (within shoreline plot):	**bedrock**	0.0
	boulders	0.1
	cobble/gravel	0.3
	loose sand	0.1
	other fine soil/sediment	0.3
	vegetated	3.6
	other	0.6
Bank Features:	**angle (O:<30; 1: 30-75; 2:nr vertical)**	0.3
	vertical dist (M from wtrln to high wt):	0.2
	horiz. dist. (M from wtrln to high wt):	0.1

Human Influence (0 = absent, 1 = adjacent to or behind plot, 2 = present within plot)

buildings	0.8
commercial	0.0
park facilities	0.2
docks/boats	1.0
walls, dikes, or revetments	0.0
litter, trash dump, or landfill	0.0
roads or railroad	0.1
row crops	0.0
pasture or hayfield	0.2
orchard	0.0
lawn	0.8
other	0.0

Physical Habitat Characteristics

station depth (at 10 m from shore)	2.9

Bottom Substrate (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

bedrock	0.0

boulders	0.0
cobble	0.2
gravel	0.9
sand	1.1
silt	3.0
woody debris	0.4

Macrophyte Areal Coverage (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

submergent	3.1
emergent	1.5
floating	1.0
total weed cover	3.4
Do macrophytes extend lakeward (-1 = yes, 0 = no)	-0.4

Fish Cover (0 = absent, 1 = Present but sparse, 2 = moderate to heavy)

aquatic weeds	2.0
snags	0.5
brush or woody debris	0.2
inundated live trees	0.3
overhanging vegetation	0.9
rock ledges or sharp dropoffs	0.0
boulders	0.0
human structures	0.3

Questionnaire

LELAND

Results compiled from 15 **Surveys.** **Average time (years) respondents spent on lake:** 15.09

Did the following add (+1), detract (-1), or have no effect (0) on your enjoyment of the lake today?

Types of WaterCraft:	-0.3	View:	0.9	Distance to Lake:	0.2
Public Access:	-0.2	Swim Beach:	0.2	Canada Geese:	0.1
Water Clarity:	-0.1	Water Qual. for Swim:	-0.1		
Fishing Quality:	0.1	Aquatic Plants:	-0.3		

On a scale of 1 (poor) to 5 (excellent), how would you rate water quality today? **2.4**

Which would you rather have, 1 or 2?

1) Better fishing and more natural habitat, or 2) clearer water?	1.4
1) Better fishing and more natural habitat, or 2) fewer aquatic plants?	1.3
1) Clearer water, or 2) fewer aquatic plants?	1.3

How important is each of the following characteristics to you (1 = very undesirable, 5= very desirable):

Restricted Watercraft:	4.4	Good Warmwtr Fishing:	3.5	Natural Scenery:	4.8
Plant Growth:	2.8	Good Swimming:	4.3	Public Beach:	3.1
Natural Shoreline:	3.9	Less Algae:	4.3	Canada Geese:	3.4
No Odors:	4.3	Public Access:	3.0		
Good Coldwtr Fishing:	4.1	Clear Water:	4.4		

Good Coldwtr Fishing: .. Clear Water: ..

Tabulated Results

Survey ID	Date	Residency		Rent or Own	Primary Activity*	Water Clarity: Purchase Factor?	Water Clarity: Has it Changed?	Water Clarity: When?
4	12/31/1998	Visitor			2	☐	Unknown	
	Bass fishing catch and release only. Campers harvest too many bass.							
7	7/7/1998	Resident	Permanent	Rent	6	☐	Unknown	
8	9/13/1998	Resident	Seasonal	Rent	2	☐	Unknown	
9	8/24/1998	Resident	Permanent	Rent	1	☐	Worse	
10	7/11/1998	Resident	Permanent	Rent	7	☐	Worse	early 90s
	too much shoreline vegetation							
11	9/13/1998	Resident	Permanent	Rent	10	☐	No	
65	8/23/1998	Resident	Permanent	Rent	10	☐	No	
66	8/25/1998	Resident	Permanent	Rent	6	☑	Worse	1997
	In order to encourage the conservation of this little lake, we need to knock out the elodia noxious weed through non-chemical means and remove gas motors from the lake.							
67	9/29/1998	Resident	Seasonal	Rent	6	☑	Unknown	
	good water quality--fecals, nitrates, etc.							
68	8/26/1998	Resident	Permanent	Rent	6	☑	Worse	10 to 15 yea
70	8/23/1998	Resident	Permanent	Rent	7	☐	Unknown	
74	8/23/1998	Resident	Permanent	Rent		☐	No	
77	8/23/1998	Resident	Permanent	Rent	6	☐	No	
78	8/22/1998	Resident	Permanent	Rent	6	☑	No	
79	8/27/1998	Resident	Permanent	Rent	2	☐	No	

* 1=canoe/kayak, 2=fish, 3=pers. wtrcrft, 4=mtrboat, 5=sail, 6=swim/wade, 7=watch wldlf, 8=ski, 9=windsurf, 10=relaxing

Zooplankton Report

LELJE1

Date 6/5/1998 Station: 1 Sample ID 22

Sample full of Aphonizomenon; 9 mLs measured

Number of organisms measured: 55

Group	Percent
Cladoceran	21.8%
Copepod	78.2%
Other	

Group	Percent
Small < 1mm	81.8%
Large >= 1mm	18.2%
Ratio of large to Small:	0.22
Average size (mm):	0.57

Date 6/5/1998 Station: 2 Sample ID 18

Lots of Aphanizominon; 6 mLs observed

Number of organisms measured: 62

Group	Percent
Cladoceran	19.4%
Copepod	80.6%
Other	

Group	Percent
Small < 1mm	64.5%
Large >= 1mm	35.5%
Ratio of large to Small:	0.55
Average size (mm):	0.73

Date 8/12/1998 Station: 1 Sample ID 29

Date may be wrong--difficult label to read; LOTS of algae in sample (mostly nostoc, and something else, single-celled).

Number of organisms measured: 145

Group	Percent
Cladoceran	17.2%
Copepod	82.8%
Other	

Group	Percent
Small < 1mm	77.2%
Large >= 1mm	22.8%
Ratio of large to Small:	0.29
Average size (mm):	0.48

Aquatic Plant Data

LELAND

Sampler: Parsons, Bell-McKinnon

Survey Date: 9/3/1998

Max depth of growth (M): 3

Comments Sunny, calm. Visited to do vegetation survey for Kirk Smith. Egeria still patchy in main part of lake, though well distributed. Also plentiful P. praelongus and P. robbinsii. Egeria not at surface in most of lake, though dense below surface at the west end.

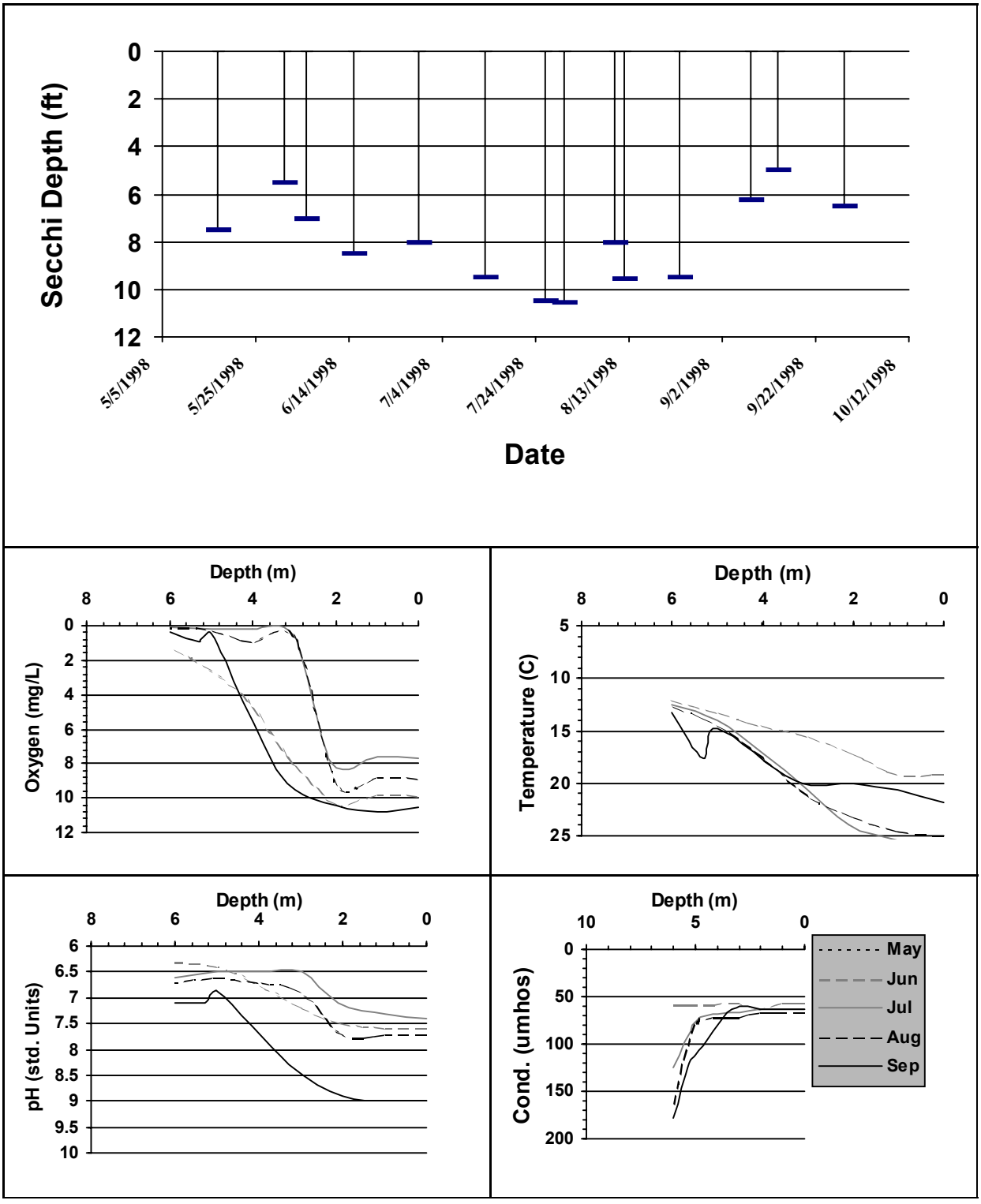
SPECIES LIST

Scientific Name	Common Name	Dist [a]	Comments
Ceratophyllum demersum	Coontail; hornwort	2	
Egeria densa	Brazilian elodea	4	flowering toward SW end, heavy epiphytic growth
Elodea canadensis	common elodea	2	
Iris pseudacorus	yellow flag	3	
Nuphar polysepala	spatter-dock, yellow water-lily	2	
Nymphaea odorata	fragrant waterlily	1	one patch seen on S shore
Phalaris arundinacia	reed canarygrass	2	
Potentilla palustris	purple (marsh) cinquefoil	2	
Potamogeton praelongus	whitestem pondweed	3	
Potamogeton robbinsii	fern leaf pondweed	3	
Potamogeton sp (thin leaved)	thin leaved pondweed	1	
Sagittaria sp.	arrowhead	1	vicinity of Don Case's house
Utricularia sp.	bladderwort	1	in wetland at NE end
Zizania aquatica	wild rice	2	

[a] 0 - value not recorded (plant may not be submersed)
1 - few plants in only 1 or a few locations
2 - few plants, but with a wide patchy distribution
3 - plants in large patches, codominant with other plants
4 - plants in nearly monospecific patches, dominant
5 - thick growth covering substrate to exclusion of other species

Secchi Depth and Profile Graphics

Station: 1 LELJE1



Secchi Data and Field Observations

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Date	Time	Temp-erature (F)	Secchi (ft)	Color (1-greens, 11-browns	Bright-ness (pct)	Wind (1-none, 5-gusty)	Rainfall (0-none, 5-heavy)	Aesthetics (1-bad, 5-good)	Swimming (1-poor, 5-good)	Geese (#)	Waterfowl (besides geese #)	Boats-Fishing (#)	Boats-Skiing (#)
Station 1													
5/17/1998		15.6	7.5	7	100	1	2	5	5	4		3	0
	Sampler: CASE			Remarks: NEW STAFF GAUGE - NEW = 2.25, OLD =14.00.									
5/31/1998		20	5.5	9	50	1	2	5	5	0	0	6	0
	Sampler: CASE			Remarks:									
6/5/1998			7	9	100			4	2	0	0	2	0
	Sampler: SMITH			Remarks: RESIDENT SUSPECTS LOGGING IN AREA HAS CONTRIBUTED TO HIGH WATER LEVELS OVER THE LAS FEW YEARS.									
6/15/1998		19.4	8.5	8	50	2	2	5	5	0	0	1	0
	Sampler: CASE			Remarks:									
6/29/1998		22.8	8	8	0	2	1	5	5	0	0	2	0
	Sampler: CASE			Remarks:									
7/13/1998		21.1	9.5	8	50	2	3	5	5	0	0	0	0
	Sampler: CASE			Remarks:									
7/26/1998		24.4	10.5	7	0	1	1	5	5	0	0	4	0
	Sampler: CASE			Remarks:									
7/30/1998			10.56	9	100	1				0	0	0	0
	Sampler: SMITH			Remarks: MUCH LESS BLUE-GREEN ALGAE THAN USE TO SEEING IN THE LAKE. VERY DARK WATER! 2 OSPREY									
8/10/1998		22.2	8	8	25	1	1	5	5	0	0	0	0
	Sampler: CASE			Remarks:									
8/12/1998			9.57		0	1		4	3	0	3	1	0
	Sampler: SMITH			Remarks: STRONG H2S IN HYPOLIMNION									
8/24/1998		22.2	9.5	7	0	2	1	5	5	0	0	1	0
	Sampler: CASE			Remarks:									

Date	Time	Temp-erature (F)	Secchi (ft)	Color (1-greens, 11-browns	Bright-ness (pct)	Wind (1-none, 5-gusty)	Rainfall (0-none, 5-heavy)	Aesthetics (1-bad, 5-good)	Swimming (1-poor, 5-good)	Geese (#)	Waterfowl (besides geese #)	Boats-Fishing (#)	Boats-Skiing (#)
9/8/1998		21.7	6.25	7	75	1	3	5	5	0	0	0	0
	Sampler: CASE			Remarks:									
9/14/1998			4.95	2	0			3	3	0	0	0	0
	Sampler: SMITH			Remarks:	The conductivity and dissolved oxygen results are qualified as estimates due to postcalibration failing QA/QC requirements.								
9/28/1998		17.8	6.5	7	0	2	1	5	5	0	0	1	0
	Sampler: CASE			Remarks:									